



# Fact Sheet

United States Nuclear Regulatory Commission  
Office of Public Affairs  
Washington DC 20555  
Telephone: 301/415-8200 E-mail: opa@nrc.gov

## Gaseous Diffusion

### Introduction

The fuel of a nuclear power plant is uranium, but only a certain type of uranium atom can be easily split to produce energy. This type of uranium atom -- called uranium-235 (U-235) -- is less than one percent of uranium as it is mined. To make fuel for reactors, the natural uranium ore is enriched to increase the percentage of U-235 to two to five percent of the uranium. This percentage is enough for a continuous splitting of uranium atoms.

### Discussion

Currently, enriched uranium is produced in the United States using the gaseous diffusion process. There are two gaseous diffusion plants currently operating in the United States -- one at Portsmouth, Ohio, and the other at Paducah, Kentucky, both operated by United States Enrichment Corporation (USEC). The Paducah facility is located in the northwestern corner of Kentucky about 10 miles west of Paducah, Kentucky, and 3 miles south of the Ohio River. The Portsmouth facility is located in south central Ohio, approximately 70 miles south of Columbus, Ohio. Together these facilities can manufacture enough enriched uranium annually to meet the electricity needs of California and New York, combined.

Currently, Paducah enriches uranium up to 2.75 percent in U<sup>235</sup> and Portsmouth further enriches the uranium to higher levels. Almost all nuclear power plants in the United States require uranium enriched to levels between 3.00 and 5.00 percent U<sup>235</sup>. USEC plans to cease uranium enrichment activities at Portsmouth in June 2001 by which time it expects the Paducah facility to be certified to enrich uranium to 5.5 percent U<sup>235</sup>.

The NRC has two full-time resident inspectors at each site. Also, specialized inspections are conducted using personnel from NRC headquarters in Maryland and the Region III office in Illinois.

### Gaseous Diffusion in the Uranium Fuel Cycle

The uranium fuel cycle begins by mining and milling uranium ore to produce yellow cake, and then converting the yellow cake into uranium hexafluoride (UF<sub>6</sub>). The UF<sub>6</sub> is then shipped to the USEC enrichment plants, where the concentration of fissionable U-235 is increased to a level for use in the commercial nuclear power program. This enriched UF<sub>6</sub> is transported to other fuel cycle facilities, where it is processed and fabricated into fuel assemblies which are then sent to nuclear power reactors.

Gaseous diffusion is based on the separation effect arising from molecular effusion (i.e., the flow of gas through small orifices). In a vessel containing a mixture of two gases, molecules of the gas with lower molecular weight

(U-235) travel faster and strike the walls of the vessel more frequently, relative to their concentration, than do the molecules of the gas with higher molecular weight. Assuming the walls of the vessel are semi-permeable, more of the lighter molecules flow through the wall than the heavier molecules. The gas that escapes the vessel is thus enriched in the lighter isotope.

## **Background**

The President signed H. R. 776, the "Energy Policy Act of 1992" (the Act), into law on October 24, 1992. Among other things, the Act amended the Atomic Energy Act of 1954 to establish a new government corporation, the USEC, for the purpose of managing and operating the uranium enrichment enterprise owned and previously operated by the Department of Energy (DOE). The Act required that, within 2 years after enactment of the legislation, the NRC was to develop standards for the USEC's two operating gaseous diffusion plants to protect public health and safety from radiological hazards and to provide for the common defense and security.

The Act further directed the NRC to establish a process under which the two gaseous diffusion plants will be certified annually by the NRC for compliance with those standards. The Act also required the NRC to report annually to Congress on the status of the gaseous diffusion plants.

In 1994, the NRC issued requirements and procedures for the certification process (10 CFR Part 76). DOE remains responsible for decommissioning the plant sites and retains ownership of the facilities; USEC began leasing the 40-year old plants on July 1, 1993.

On April 26, 1996, the President signed into law H.R. 3019, "The USEC Privatization Act," which provides for USEC to become a private corporation. The law also changed certain regulatory provisions, including extending the certification period from one year to five years as determined by the NRC.

On November 26, 1996, the NRC issued USEC initial certificates of compliance for the two plants and NRC assumed regulatory oversight on March 3, 1997. The first annual report to Congress on the status of the gaseous diffusion plants was issued January 5, 1998.

The President signed into law the "Federal Reports Elimination Act of 1998," Public Law 105-362, on November 10, 1998, which modified the requirement for NRC to issue an annual report to Congress on the gaseous diffusion plants. The law now states that the report to Congress does not have to be annually but is to be issued "not later than the date on which a certificate of compliance is issued."

The second Report to Congress was issued on January 16, 1999, followed by the renewal of the certificates of compliance issued on January 29, 1999. The current certificates will expire on December 31, 2003, unless the USEC has submitted an acceptable renewal application before that date. The next report to Congress will be issued following the renewal decision at that time.

DOE has outlined a plan to construct an advanced technology demonstration plant for uranium enrichment in Piketon, Ohio. This plant is important to the security of the United States electricity supply. DOE has projected completing the advanced enrichment technology in five years.

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